For debate: Pet birds as an independent risk factor for lung cancer

Peter A Holst, Daan Kromhout, Ronald Brand

Abstract

To find out whether keeping birds in the home is an independent risk factor for lung cancer a case-control study was carried out in four main hospitals in The Hague, The Netherlands. Forty nine patients under 65 years of age with lung cancer each were matched for age and sex with two control subjects who attended the same general practice. Data were collected on social class, cigarette smoking, intake of β carotene and vitamin C, and alcohol consumption.

It was found that smoking, birdkeeping, and a low intake of vitamin C were significantly and independently related to the incidence of lung cancer. The odds ratio for lung cancer among people who keep birds as pets was estimated to be 6·7 after adjusting for smoking and vitamin C intake. The results of this study suggest that keeping pet birds is an independent risk factor for lung cancer.

Introduction

Smoking, occupational factors, and open air pollution do not explain fully the incidence and geographical patterns of lung cancer.[1,2] Occupational exposures to asbestos and uranium, for example, are strong risk factors. These, however, affect only a small proportion of the total population, whereas other factors such as indoor air pollution and a low intake of antioxidants in the diet—for example, β carotene—should also be considered.[3,4] Keeping birds as pets in the home contributes greatly to indoor pollution.[5]

In a survey carried out from 1972 through 1981 in a general practice in The Hague an association was found between keeping pet birds and lung cancer.[6] We decided to test the hypothesis that birdkeeping is an independent risk factor for lung cancer and report the results of a case-control study.

Methods

The study began in April 1985 in four hospitals in The Hague, which has about 450 000 inhabitants. Only patients with primary malignant neoplasms of the trachea, bronchus, and lung (International Classification of Diseases 162), who were aged under 65, had lived in The Netherlands since 1965, and were registered with one general practice in The Hague during the study were selected for the study. Patients who were too ill to fill in a questionnaire were excluded from the study. Two control subjects matched for age and sex were randomly selected in the practice for each patient. Before the study started we decided to perform an interim analysis after 1 January 1987 if the number of patients reached 50.

Between 1 April 1985 and 1 January 1987 there were 76 patients under 65 in the four hospitals with cancer of the lung. Thirteen were excluded by chest specialists, according to the protocol, because of having cerebral metastases (four) or terminal disease (nine). Thus 63 patients were eligible for entry in to the study. Fourteen of these did not participate: three were being treated by other specialists, and holiday periods and changing personnel prevented the others from participating. These 14 patients were classified as missing. The remaining 49 patients (79% of the total) participated. Two controls refused to participate and were replaced by two others selected by the same methods.

Tumours were classified according to World Health Organisation criteria by the pathologists as epidermoid carcinoma (I), small cell carcinoma (II), adenocarcinoma including bronchoalveolar carcinoma (III), and large cell carcinoma (IV).

Nine chest specialists and 48 general practitioners handed out questionnaires to patients and control subjects respectively, who completed them by themselves. The standardised questionnaire asked about occupation, smoking habits, birdkeeping, and diet. The occupation of the wage earner was taken as the indicator of the social class of the household. The participants were assigned to high and low social class according to the International Standard Classification of Occupations. Questions about smoking habits included type of tobacco, whether cigarettes, cigars, or a pipe were smoked, and amount and duration of smoking. A patient or control was considered to be a smoker if he or she had ever smoked up to and including the fifth year before cancer was diagnosed (patient) or the date of the examination (control). Information was collected on how long birds were kept and the type of birds. A patient or control was considered to be a birdkeeper if he or she had had caged birds in the home for longer than six consecutive months from five to 14 years before lung cancer was diagnosed (patient) or before the examination (control). (It takes at least five years (25-30 cell divisions) before a tumour in epithelial cells becomes detectable by *x* ray examination.) Information on diet was collected by questions about how often fruit and vegetables containing β carotene and vitamin C were eaten and about the consumption of alcohol. The intake of β carotene and vitamin C was calculated using average portion size and multiplying the intake of foods with their nutrient content.

Conditional logistic regression analysis was used in assessing odds ratios because of the stratified structure of the case-control study.[7]

Results

Of the 76 patients, 29 had epidermoid carcinoma, 22 small cell carcinoma, 10 adenocarcinoma, three alveolar carcinoma, and 12 large cell carcinoma. Of the 49 patients in the study, the numbers were 14, 21, five, none, and nine. The average age of the 49 patients at diagnosis was 56·9 years. For the 37 men it was 57·9 years, and for the 12 women 53·9 years. The average

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age of the control subjects was 57. Patients and controls did not differ appreciably by social class: 78% of the patients and 67% of the controls were classified as being in the lower social class.

Of the patients, 98% were smokers, and 84% of controls were smokers. The average number of cigarette years (one cigarette year is one cigarette a day during one year) of smoking was 651 (SEM 48·0) for the patients and 448 (SEM 38·7) for the controls, a highly significant difference ($p<0·001$). The percentage of patients who kept birds was twice as high as that for controls (67% *v* 35%) (table I). It is notable that the one patient who did not smoke kept birds. Nine of the 10 patients under age 50 were birdkeepers compared with 11 of the 20 controls aged under 50. The patients had a significantly lower intake of vitamin C than the controls ($p<0·05$) (table II). No difference was observed in β carotene and alcohol intake between patients and controls.

TABLE I—*Characteristics of lung cancer patients and controls. Figures are numbers (and percentages)*

	Patients (n=49)	Controls (n=98)
Men	37 (76)	74 (76)
Women	12 (24)	24 (24)
Age (years):		
35-39	1 (2)	2 (2)
40-44	3 (6)	6 (6)
45-49	6 (12)	12 (12)
50-54	5 (10)	10 (10)
55-59	14 (29)	28 (29)
60-65	20 (41)	40 (41)
Ever smoked through 5th year before date of diagnosis:	48 (98)	82 (84)
1-15 cigarettes per day	8 (16)	29 (30)
>15 cigarettes per day	40 (82)	53 (54)
Birdkeeping five to 14 years before diagnosis:	33 (67)	34 (35)
Lower social class	38 (78)	66 (67)

TABLE II—*Details of smoking and diet for lung cancer patients and controls*

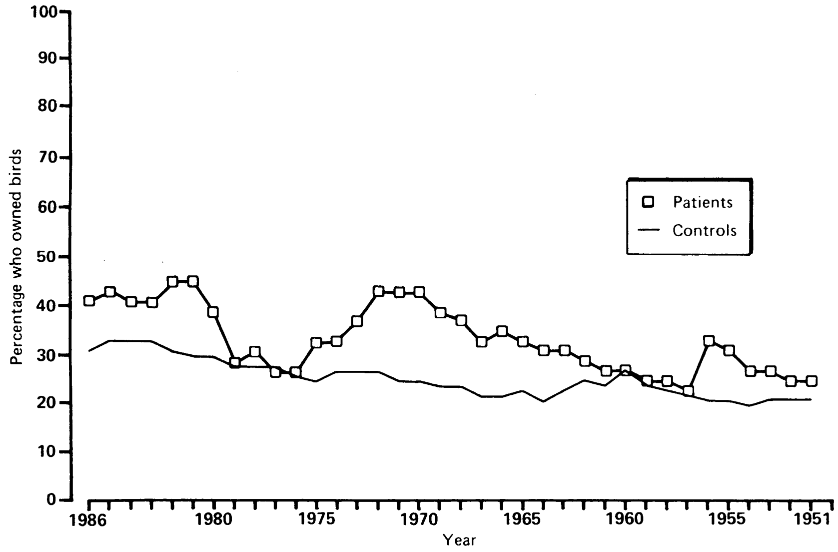
	Patients		Controls	
	Mean	SEM	Mean	SEM
Smoking (cigarette years)	651	48·0	448	38·7
Vitamin C (mg/day)	64·8	7·9	84·7	5·1
β Carotene (mg/day)	2·8	0·23	2·73	0·15
Alcohol (units per week)	12·0	1·8	10·0	1·1

Multiple conditional logistic regression analyses were carried out which show that the interactions between sex and birdkeeping and between age and birdkeeping were not significant. Thereafter the risk of lung cancer was modelled as a function of birdkeeping, smoking, vitamin C, β carotene, and alcohol intake, and social class. A backward regression analysis showed that social class and alcohol intake were not significantly related to the risk of lung cancer. Moreover, deleting these two factors from the model did not influence the coefficients of the remaining factors appreciably. Thus there was no danger of a confounding effect in simplifying the model. In the final model the risk of lung cancer was related to birdkeeping, smoking, and intake of vitamin C (table III). This analysis showed that these three risk factors were independently related to lung cancer. Birdkeepers had a risk of lung cancer 6·7 times greater than those who did not keep birds, and the adjusted odds ratios for smoking and low vitamin C intake did not differ from the crude odds ratios.

TABLE III—*Crude and adjusted odds ratios for the various risk factors of lung cancer*

	Odds ratios	
	Crude	Adjusted (95% confidence interval)
Birdkeeping (yes *v* no)	5·1	6·7 (2·2 to 20·0)
Smoking (yes *v* no)	10·0	10·0 (1·2 to 83·0)
Vitamin C intake (>50 mg/day *v* ≤50)	0·23	0·23 (0·1 to 0·6)

The figure of bird ownership from 1951 to 1986 shows that the percentage of bird keepers was always higher among the patients than among the controls and that the hobby of keeping birds increased during these years. This implies that the association that we found is not due to the chosen time interval and the definition of bird keepers.



Percentage of patients and control subjects in the study who kept birds as pets between 1951 and 1986

Discussion

The 14 patients who were eligible to participate in the study but did not do so (defined as missing) were less likely to have small cell tumours than those who participated, and their absence may have affected the relation between birdkeeping and lung cancer observed here. To assess whether there was bias an analysis was performed, assuming that in the most extreme case each missed case would have been classified as non-birdkeeper while their (fictitious) controls were randomly assigned to be a birdkeeper or a non-birdkeeper proportionally to the distribution in the other control subjects. Of course, this greatly reduced the estimated odds ratio (to 2·8), but this estimate was still significant at the 1% level. Even in this extreme case our results cannot be explained by chance alone. It is unlikely that the reason for being missed as a case is related to the exposure. Therefore the estimated odds ratio will probably not be severely biased.

People who keep birds are inhaling and expectorating excess allergens and dust particulates. Both smoking and birdkeeping cause dysfunction of lung macrophages, which is followed by local deficiency in humoral[8] and cellular immunity.[9,10] The consequence of this is less protection of the whole bronchial epithelium against continuous immunogenic and particulate material in the bronchial fluid layer.

There is also demographic evidence for an association between birdkeeping and lung cancer. There are regional differences in mortality from lung cancer in The Netherlands that cannot be explained by the differences in the age distribution of the population.[11] Unfortunately, regional information about smoking habits is not available. The rural province of North Brabant had the highest age standardised lung cancer mortality between 1969 and 1984. Most of the bird clubs and most of the organised birdkeepers are traditionally found in North Brabant. The number of organised bird breeders in The Netherlands has grown 10-fold since 1950. Bird breeding is pre-eminently a male hobby in our country. For years Belgium, The Netherlands, and the United Kingdom have had the highest standardised lung cancer mortality in the world.[12] Rates in the United States were always lower even though there were no fewer smokers in the past.[13]

Sixty to 80% of the trade in tropical birds is concentrated in Belgium, The Netherlands, and the UK.[14] Most of the organised birdkeepers are in these countries and most of the shows are held there. In 1980 in the United States there were 25·6 million birds in households per 230 million inhabitants and 7·5 million per 13·6 million inhabitants in The Netherlands.[15] It is possible to transport and import large numbers of birds by air cargo. Keeping species of domestic and tropical birds as pets has become very popular in this century, and this might have contributed to the increasing mortality in men from lung cancer in The Netherlands, Belgium, and the UK.

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Management of perinatal loss of a twin

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Abstract

The death of a twin during pregnancy or around birth gives rise to a bewildering confusion of thoughts and feelings that can impede mourning and disturb the bereaved mother's care of a surviving twin. Every effort should be made to give the parents and siblings an experience of the dead baby. Photographs especially can reduce confusion and assist reality testing and thus facilitate the grieving process and improve the care of the surviving twin.

Introduction

Death at birth or in the womb, though natural and common events, seem contradictory and against the natural order of life. When birth and death are fused not only hurt and bitter disappointment but confusion and unreality are felt. After months of growing fullness the mother finds a sudden emptiness. Even after a live birth women may experience an emptiness, but the bereaved mother has far stronger emotions: hurt and shame, failure as a mother, and guilt without reason. She has unmanageable, conflicting feelings of love and hate for her dead baby, for other babies, and for other women in childbirth. Grievances abound and distract her from grieving. Bad feelings about what has been lost have to be disentangled from good ones to avoid idealisation on the one hand and chronic unresolved grievances on the other.[1]

A death at birth is associated with a confusion of thoughts and feelings. As a result the parents' thinking is impaired, their testing of reality is undermined, and bizarre reactions and actions can occur, not only in the bereaved family but also in those who care for them.[2] For example, a vicar reluctantly allowed a stillborn infant to be buried in his graveyard but insisted that the gravestone should be left blank.

Mourning during pregnancy is hard. For normal mourning it is necessary to hold images of the dead person in the mind until eventually there is resolution of grief and relinquishment. This process could interfere with the similar yet vitally different state of mind required during pregnancy—that of cherishing the idea of the baby inside the mother's body. The mother will feel the baby is endangered by the bad feelings and frightening ideas inevitable in the mourning process.

This same emotional complexity exists when a twin dies during pregnancy or soon after its birth.[3] When one twin survives and the other dies, not only the bereaved but also those who care for them are faced with contradictory psychological processes. The celebration of the birth of the live baby and the increasing emotional commitment of the mother contrast with the opposing processes of sorrowful relinquishment and of coming to terms with the painful emptiness of stillbirth.[4,5] The dead baby may seem a fantasy, particularly if no tangible memories and mementos remain. Bad memories get lost rather than relinquished. As a mother's full commitment is necessary for effective nurturing of her newborn live baby, the mourning processes may understandably be postponed; if not resumed later they may give rise to the various syndromes of failed mourning. On the other hand, the mother may grieve compulsively for the dead baby and be unable to devote herself to the care of the live baby. Excessive polarisation of feelings about the live and the dead twin may occur if she starts idealising the dead baby (her "angel baby"), especially if the surviving twin is difficult to handle or worrying because of behaviour or illness.

Management of dying and death

Every effort must be made to give the parents and siblings an experience of the dead or dying baby, as has been described for singleton stillbirth.[6-8] If one twin is likely to die the family should be encouraged to spend extra time with this one so that precious memories can be created, and the parents may later find comfort in knowing that they have given as much love and care to this baby as they could.

Twins are often premature and often surrounded by medical paraphernalia, and therefore they look

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